

Addendum.—Since the above was written I have received Professor Auwers' *Tafeln zur Reduction von Stern-Catalogen auf das System des Fundamentalcatalogs des Berliner Jahrbuchs*. From the comparison given in Table VII. it will be seen that the corrections depending on declination, $\Delta\alpha_s$, which he finds to be necessary to reduce the Oxford right ascensions to his system are, to a great extent, accounted for by the pivot errors as determined in this paper.

TABLE VII.

N.P.D.	Red. to Fund. Cat.	Corr. for Pivot Error. s	N.P.D.	Red. to Fund. Cat. s	Corr. for Pivot Error. s
10°	+0.125	+0.062	70°	-0.003	-0.018
15	+0.113	+0.060	75	0.000	-0.013
20	+0.095	+0.067	80	+0.005	-0.004
25	+0.075	+0.0115	85	+0.014	+0.001
30	+0.056	+0.138	90	+0.026	+0.002
35	+0.040	+0.082	95	+0.041	+0.001
40	+0.027	+0.040	100	+0.062	+0.010
45	+0.018	+0.015	105	+0.084	+0.027
50	+0.009	+0.004	110	+0.101	+0.036
55	+0.002	-0.008	115	+0.120	+0.062
60	-0.001	-0.020	120	+0.137	+0.079
65	-0.003	-0.018			

The Positions of Seventy Stars in the Cluster M 13 Herculis.

By H. C. Plummer, M.A.

The complete investigation, so far as it can be made by photographic means, of a dense cluster, such as *M 13 Herculis*, must naturally be based on plates taken with a telescope of great focal length and high resolving power. To secure such plates is in fact one of the important functions of the very largest refractors. But the large-scale photographs thus obtained may cover so small a region of the sky that they contain no stars whose meridian places are known and by which the reduction of the plates can therefore be made. In this case it is necessary to determine the positions of a sufficient number of reference stars by some auxiliary means. This has been done for the cluster mentioned at the request of the director of the Liverpool Observatory, who is at present discussing a photograph taken with the Yerkes refractor.

The Oxford plate (No. 2372) was taken with the astrographic instrument on 1904 September 17. An exposure of eighty

minutes was given (from $19^{\text{h}} 50^{\text{m}}$ to $21^{\text{h}} 10^{\text{m}}$ sidereal time). The adopted plate centre is

$$1900^{\circ} \left\{ \begin{array}{l} \text{R.A. } 16^{\text{h}} 38^{\text{m}} 0^{\text{s}} \\ \text{Decl. } +36^{\circ} 40' 0'' \end{array} \right.$$

The comparison stars (thirty-three in number) are taken from the *Lund A.G. Catalogue*, and the relations between their computed coordinates (ξ , η) and the corresponding measured coordinates (x , y) are found to be

$$\begin{aligned} x - \xi &= -0.00065 \quad x + 0.00395 \quad y - 0.1628 \\ y - \eta &= -0.00421 \quad x - 0.00050 \quad y + 0.4014 \end{aligned}$$

Table I. gives the results of the comparison with the Lund meridian places. The first column gives the A.G.C. number and the second and third columns give the standard coordinates for $1900^{\circ} 0'$, calculated from the catalogue with the unit $5' = 1$ réseau interval and increased by 13 . The fourth and fifth columns contain the residuals in R.A. and Declination in the sense of corrections to the Lund places.

The stars whose positions are given in Table II. extend over a field which is the same as that covered by Plate 34 in the late Dr. Roberts' *Stars, Star Clusters, and Nebulae*, vol. i., and have all been identified on this plate. The reference number is in order of R.A. The columns headed x and y contain the standard coordinates for $1900^{\circ} 0'$, expressed in minutes of arc and referred to the centre above stated. The fourth and fifth columns give the deduced R.A. and Declination for the epoch $1900^{\circ} 0'$. The measures of the cluster stars have been made in four orientations of the plate by means of one of the ordinary Oxford micrometers, in which an eye-piece scale gives direct readings to 0.001 of a $5'$ réseau interval. A certain want of definition in the images of these stars made it appear better to multiply the number of independent settings on the star images than to increase the mere accuracy of the readings.

TABLE I.

Lund A.G.C.	ξ .	η .	$\Delta\alpha.$ s	$\Delta\delta.$ $''$
6817	0.7127	7.9992	+0.06	-0.3
6818	1.8326	18.4231	+0.22	+0.4
6822	3.3115	25.3513	+0.01	-0.5
6823	3.7436	23.1591	-0.16	-0.5
6825	4.9867	21.1180	+0.07	+2.2
6828	5.8256	21.8189	-0.04	-0.2
6829	5.7759	6.1078	+0.01	+0.2
6830	5.9472	3.2107	-0.06	+0.2
6833	7.4238	1.7660	+0.01	-0.5

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Lund A.G.O. No.	ξ .	η .	$\Delta\alpha.$ s	$\Delta\delta.$ "
6836	8.2174	13.2583	+0.05	-1.1
6838	8.4315	1.5274	+0.03	+0.9
6840	9.2697	25.5471	-0.09	0.0
6844	9.9932	23.6048	-0.10	0.0
6846	10.2429	19.7579	+0.08	+0.2
6848	10.5654	3.4090	-0.14	+0.1
6850	11.7567	9.7306	+0.02	-1.1
6851	12.0784	19.0228	+0.02	-0.3
6857	14.5183	8.3966	+0.11	+0.3
6863	16.6194	13.3717	+0.02	-0.7
6864	17.1310	19.8546	+0.08	+0.1
6865	18.0451	11.8143	-0.04	-0.5
6867	19.9075	23.7595	+0.12	-1.0
6868	20.1439	10.3230	-0.02	-0.6
6869	20.7401	4.0765	-0.07	+1.2
6870	20.8000	4.6149	+0.03	-0.4
6876	22.8420	20.2366	+0.01	-1.7
6878	23.1917	2.7869	+0.08	+1.6
6880	23.3958	16.2414	-0.01	+1.2
6882	24.2654	15.5270	+0.03	-0.8
6883	24.1711	23.4301	-0.20	-0.1
6884	24.7864	6.9385	-0.03	-0.6
6885	24.9923	16.3677	-0.15	-0.3
6886	24.9972	19.1082	+0.12	+2.5

TABLE II.

Ref. No.	1900.0.		1900.0.			
	x .	y .	R.A.		Decl.	
		h	m	s		"
1	- 6.958	-0.408	16	37	25.30	+36 39 35.2
2	- 5.696	-3.098		37	31.62	36 53.9
3	- 5.620	+5.046		37	31.94	45 2.6
4	- 5.582	-0.249		37	32.16	39 44.9
5	- 5.258	+1.605		37	33.77	41 36.1
6	- 4.805	-6.881		37	36.08	33 7.0
7	- 3.920	+4.878		37	40.43	44 52.6
8	- 3.874	-5.217		37	40.70	34 46.9
9	- 3.811	+0.907		37	40.99	40 54.3
10	- 3.594	-8.882	16	37	42.11	36 31 7.0
						G

Ref. No.	1900°.o.		1900°.o.			Decl.
	x.	y.	h	m	s	
11	- 3.474	-2.694	16	37	42.69	+ 36° 37' 18.3"
12	- 3.031	-7.248		37	44.91	32° 45.1'
13	- 2.974	-1.907		37	45.18	38° 5.5'
14	- 2.944	-3.865		37	45.33	36° 8.0'
15	- 2.926	+2.591		37	45.40	42° 35.4'
16	- 2.652	-0.534		37	46.78	39° 27.9'
17	- 2.117	+1.760		37	49.44	41° 45.6'
18	- 2.073	-3.000		37	49.67	37° 0.0'
19	- 1.957	-2.753		37	50.25	37° 14.8'
20	- 1.663	-9.208		37	51.72	30° 47.5'
21	- 1.652	-5.678		37	51.77	34° 19.3'
22	- 1.436	-0.520		37	52.84	39° 28.8'
23	- 1.346	+5.422		37	53.28	45° 25.3'
24	- 1.266	-3.060		37	53.69	36° 56.4'
25	- 0.866	+3.400		37	55.68	43° 24.0'
26	- 0.732	+1.191		37	56.35	41° 11.5'
27	- 0.664	-2.547		37	56.69	37° 27.2'
28	- 0.442	-0.035		37	57.80	39° 57.9'
29	- 0.398	-0.950		37	58.02	39° 3.0'
30	- 0.376	-3.827		37	58.13	36° 10.4'
31	- 0.127	-2.411		37	59.37	37° 35.3'
32	+ 0.332	-0.727		38	1.66	39° 16.4'
33	+ 0.377	-3.372		38	1.88	36° 37.7'
34	+ 0.472	+2.316		38	2.36	42° 19.0'
35	+ 0.813	-0.037		38	4.06	39° 57.8'
36	+ 0.834	-5.871		38	4.15	34° 7.7'
37	+ 0.870	-2.910		38	4.34	37° 5.4'
38	+ 1.392	+0.264		38	6.94	40° 15.8'
39	+ 1.389	+5.644		38	6.94	45° 38.6'
40	+ 1.664	-2.082		38	8.30	37° 55.1'
41	+ 1.811	-2.104		38	9.03	37° 53.8'
42	+ 1.904	-5.997		38	9.48	34° 0.2'
43	+ 2.266	+2.559		38	11.31	42° 33.5'
44	+ 2.278	+1.629		38	11.36	41° 37.7'
45	+ 2.284	+1.416	16	38	11.39	36° 41' 24.9"

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Ref. No.	1900°o.		1900°o.		
	x.	y.	h	m	s
46	+ 2°550	- 2°607	16	38	12°71
47	+ 2°654	- 0°090		38	13°24
48	+ 3°186	- 4°306		38	15°87
49	+ 3°196	- 4°881		38	15°92
50	+ 3°228	+ 1°140		38	16°10
51	+ 3°352	+ 4°739		38	16°73
52	+ 3°360	+ 0°332		38	16°76
53	+ 3°572	- 2°096		38	17°80
54	+ 3°576	- 5°911		38	17°81
55	+ 4°092	- 1°206		38	20°40
56	+ 4°228	+ 0°438		38	21°08
57	+ 4°315	+ 4°864		38	21°54
58	+ 4°504	+ 1°461		38	22°47
59	+ 4°620	- 3°228		38	23°02
60	+ 4°636	+ 5°332		38	23°14
61	+ 5°045	- 0°819		38	25°15
62	+ 5°308	- 5°020		38	26°44
63	+ 5°624	+ 3°228		38	28°06
64	+ 6°722	+ 1°002		38	33°53
65	+ 7°110	- 6°172		38	35°41
66	+ 8°166	- 1°300		38	40°71
67	+ 8°222	- 0°669		38	41°00
68	+ 8°468	- 3°642		38	42°20
69	+ 8°900	+ 0°666		38	44°39
70	+ 10°003	- 0°938	16	38	49°88
					36 39 3°1

University Observatory, Oxford:
1904 November 8.

Note on the Variation of ϵ Aurigæ. By Colonel E. E. Markwick.

Dr. Ludendorff, of Potsdam, has recently published a paper on the variability of ϵ Aurigæ, in which he reaches some rather remarkable conclusions. Having discussed a considerable number of observations of the brightness of this star made by observers of repute, commencing with those of Argelander in 1842, he